Goddard SPACE FLIGHT CENTER

NASA

PACE Plankton, Aerosol, Cloud, ocean Ecosystem

The U.S. ocean economy contributes over $350B to the GDP (2014) and supports more than 3.1 million jobs (one in 45). Currently, this ocean economy, including the Great Lakes, is growing faster than the total U.S. economy in both contributions to inflation-adjusted GDP (15.6% since 2007 compared to 5.8%) and jobs (8.1% compared to flat).

The ocean teems with life, supporting economies and food security and providing for our everyday health and welfare. Phytoplankton (microscopic marine plants and algae) form the base of our food chain, produce about half of the oxygen on Earth, and remove carbon dioxide from the atmosphere. Like land plants, they are very diverse, and not all phytoplankton are beneficial – harmful algae can contaminate drinking water, kill fish, and close recreational areas.

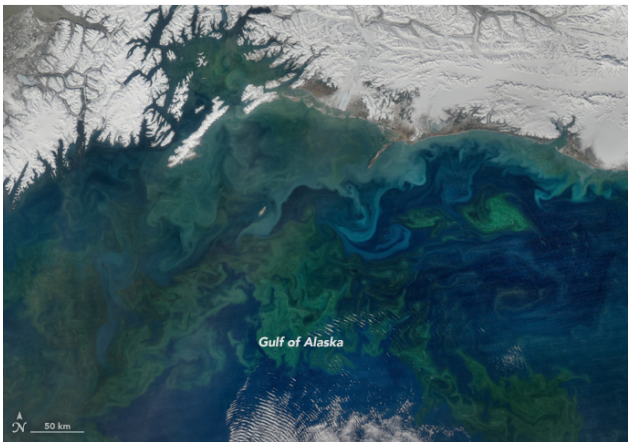
PACE will be the first mission to provide measurements that enable prediction of the boom-bust of fisheries, the appearance of harmful algae, and other factors that affect commercial and recreational industries (2022 launch). While current satellites provide essential tools for monitoring the ocean, coasts, and Great Lakes, they cannot effectively be used to evaluate changes to fisheries or identify harmful algae. Without PACE, we will continue to be blind to the impacts of diversity changes in our marine resources.

PACE will also observe clouds and microscopic airborne particles known as aerosols that scatter and absorb sunlight. Industry, DOD, NOAA, policy makers, and scientists all rely on these key data for weather, visibility, and air quality forecasts. Observing the ocean, clouds, and aerosols together will reveal previously unseen interactions, including their exchange of carbon dioxide, how some aerosols can fuel phytoplankton blooms, and how phytoplankton can release particles to the atmosphere that lead to the formation of clouds. These processes affect how much heat is trapped by Earth's atmosphere and are vital to accurately predict weather and climate.

Example PACE user communities:

- Natural and coastal resource managers focused on water quality for human health, commercial fishing, and disaster management
- Researchers and Earth modelers in the fields of ocean biology-ecology- biogeochemistry, atmospheric aerosols, and clouds
- Military users of ocean optical data for environment characterization and clouds and aerosol data for weather and visibility forecasts for regions of operations
- Government agencies, including NOAA, USGS, and the EPA, who will use this data to manage fisheries and to determine human health predictors including air and water quality
- Renewable energy and commercial sectors with interest in environmental technology development, resources management tools, and environmental forecasting
- Educators of the general public
- Policy makers and economists at local, state, regional, tribal, federal, and international levels

Ultimately, PACE will provide atmospheric and oceanic observations that benefit society in ways that current satellites cannot. For operational users, policy makers, the commercial sector, and scientists, PACE will offer new and advanced opportunities to monitor fisheries and harmful algae and improve our understanding of water resources, the impact of disasters, ecological forecasting and human health, and air quality.

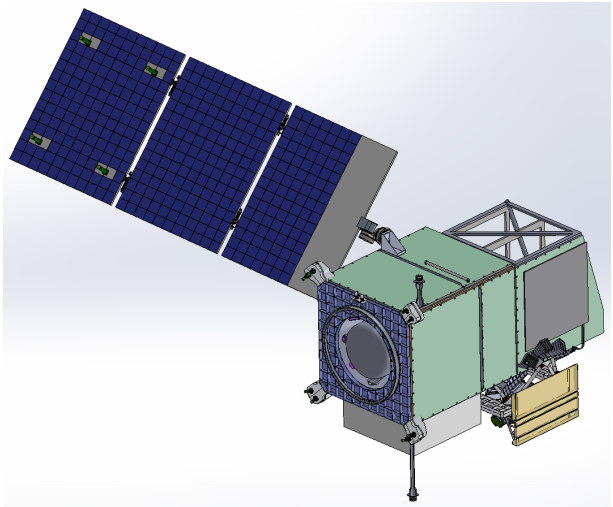


MODIS/Aqua true color image showing riverine outflow and phytoplankton blooming in the Gulf of Alaska, with clouds to the south and snow-covered land in the north over Alaska on April 12, 2017. Credit: NASA GSFC

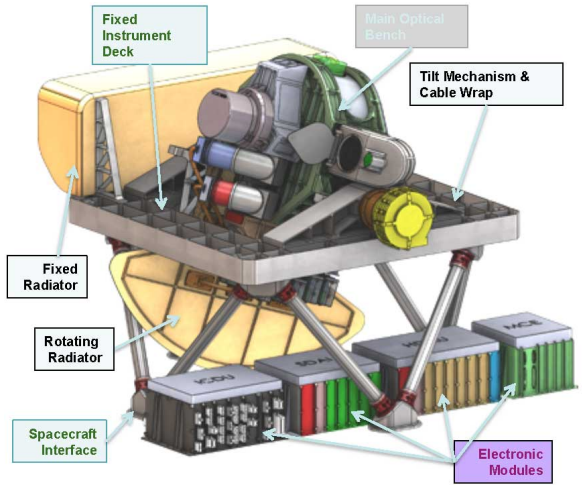
MODIS/Terra true color image of Lake Erie between Ohio, Pennsylvania, New York and Ontario on June 9, 2016. Nutrients from farms and septic systems promote excessive blooms that harm water quality and marine life. Credit: NASA LANCE/EOSDIS

Clams are hauled in, rinsed, bagged and tagged for market in Little Peconic Bay, Southampton, New York. Credit: U.S. Food and Drug Administration

NASA/NOAA/DOD Suomi NPP/VIIRS image of smoke from the Soberanes fire in California on July 24, 2016. Credit: NASA LANCE/EOSDIS



PACE spacecraft is 1.45m x 1.45m x 3.7 to its top.



The PACE Ocean Color Instrument will sense over an exceptionally broad spectrum of wavelengths to distinguish phytoplankton communities and aerosol size and type, such as dust, smoke, sea salt.